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Bibliography

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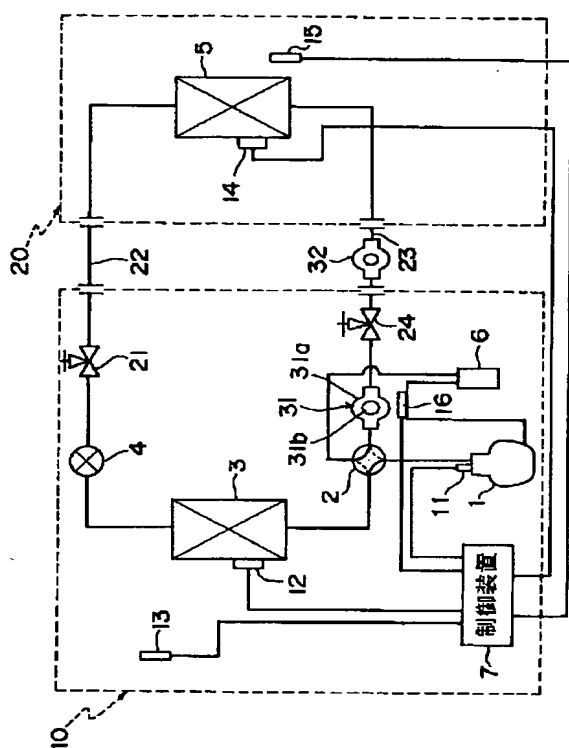
## Epitome

### (57) [Abstract]

[Technical problem] Extent of degradation of refrigerating machine oil can be judged with an easy configuration, and the freezer which can maintain dependability over a long period of time is offered.

[Means for Solution] It has the oil degradation decision container 31 arranged between the 4 way change-over valve 2 and the gas closing valve 24. Since the included gas refrigerant carries out the regurgitation of the refrigerating machine oil from a compressor 1 at the time of heating operation, extent of oil degradation can be judged easily.

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## CLAIMS

## [Claim(s)]

[Claim 1] The freezer characterized by having oil degradation decision equipment (31) for judging extent of degradation of the refrigerating machine oil arranged between the discharge side of a compressor (1) and a gas closing valve (24) or between the 4 way change-over valve (2) and the gas closing valve (24).

[Claim 2] The freezer characterized by having oil degradation decision equipment (32) for judging extent of degradation of the refrigerating machine oil arranged in gas side interunit piping (23).

[Claim 3] The freezer characterized by using a HFC system refrigerant in a freezer according to claim 1 or 2.

[Claim 4] The freezer characterized by using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more in a freezer according to claim 1 or 2.

[Claim 5] The freezer characterized by preparing the simplified soil identification section in the above-mentioned oil degradation decision equipment (31 32) in claim 1 thru/or the freezer of any one publication of four.

[Claim 6] The freezer characterized by preparing the simplified soil identification section by which the coloring matter which can judge oxidation of an oil was applied to the above-mentioned oil degradation decision equipment (31 32) in a freezer according to claim 1 to 4.

[Claim 7] The freezer characterized by having a decision table (53) for judging the degree of oxidation of the above-mentioned oil in a freezer according to claim 6.

[Claim 8] Wear powder decision equipment characterized by using the magnet which can judge the amount of the wear powder in a refrigerant circuit.

[Claim 9] The freezer characterized by having a decision table (55) for judging the amount of the above-mentioned wear powder in wear powder decision equipment according to claim 8.

[Claim 10] The freezer characterized by using wear powder decision equipment according to claim 8 or 9.

[Claim 11] Refrigerant oxidation decision equipment characterized by having the simplified soil identification section to which the coloring matter which can judge oxidation of a refrigerant was applied.

[Claim 12] The freezer characterized by having a decision table for judging the degree of oxidation of the above-mentioned refrigerant in a freezer according to claim 11.

[Claim 13] The freezer characterized by using refrigerant oxidation decision equipment according to claim 11 or 12.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a freezer, wear powder decision equipment, and refrigerant oxidation decision equipment.

[0002]

[Description of the Prior Art] In the freezer of a heat pump method using a refrigerant, since the HCFC system refrigerant with large ozone depletion potential was set as the object of fluorine regulation, the HFC system refrigerant of ozone-depletion-potential zero is used as the alternative refrigerant. In the freezer using this HFC refrigerant, since the mutual solubility of refrigerating machine oil and a HFC refrigerant is set to one of the important properties, synthetic oil, such as an ether oil and ester oil, is used as refrigerating machine oil. However, the above-mentioned synthetic oil has a strong polarity, therefore in the reduced pressure control which consisted of electric expansion valves, plugging and initial failure by a

sludge etc. after a refrigerant evaporates arise, and it has the problem that abnormalities occur in a refrigerating cycle and dependability in order to tend to melt residual impurities other than refrigerating machine oil and a refrigerant.

[0003] Moreover, since there is no means to judge the amount of the wear powder which comes out from a compressor etc. in a refrigerant circuit in the above-mentioned freezer, the stage to remove wear powder cannot be judged, but in the reduced pressure control constituted by the electric expansion valve, plugging and initial failure by wear powder arise, and there is a problem that dependability is not securable over a long period of time.

[0004] Moreover, in the above-mentioned freezer, since there is no means to judge the amount of the decomposition product (harmful matter, such as fluoric acid and a phosgene) produced by oxidation of a refrigerant, the stage of exchange of the refrigerant which deteriorated cannot be judged but there is a problem that dependability is not securable over a long period of time.

[0005] Then, the purpose of this invention is to be able to judge extent of degradation of refrigerating machine oil with an easy configuration, prevent plugging of reduced pressure control, and offer the freezer which can maintain dependability over a long period of time.

[0006] Moreover, it is in being able to judge the amount of the wear powder in a refrigerant circuit with the configuration with an already easy blindness-in-one-eye target which is this invention, preventing plugging of reduced pressure control, and offering the wear powder decision equipment which can maintain long-term dependability, such as a freezer.

[0007] Moreover, extent of oxidation of a refrigerant can be judged with the configuration with an already easy blindness-in-one-eye target which is this invention, and it is in offering the refrigerant oxidation decision equipment which can maintain long-term dependability, such as a freezer.

[0008]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the freezer of claim 1 is characterized by having oil degradation decision equipment for judging extent of degradation of the refrigerating machine oil arranged between the discharge side of a compressor and a gas closing valve or between the 4 way change-over valve and the gas closing valve.

[0009] Since the included gas refrigerant carries out the regurgitation of the refrigerating machine oil to gas side piping from a compressor by attaching oil degradation decision equipment between the discharge side of a compressor, and a gas closing valve, or between a 4 way change-over valve and a gas closing valve (gas side piping at the time of heating operation) according to the freezer of above-mentioned claim 1, it becomes possible to judge extent of oil degradation easily. Therefore, by being able to judge extent of degradation of refrigerating machine oil with an easy configuration, and exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on the decision result, plugging of reduced pressure control etc. can be prevented and dependability can be maintained over a long period of time.

[0010] Moreover, the freezer of claim 2 is characterized by having oil degradation decision equipment for judging extent of degradation of the refrigerating machine oil arranged in gas side interunit piping.

[0011] According to the freezer of above-mentioned claim 2, by the split type which has an outdoor unit and an indoor unit, since the included gas refrigerant carries out the regurgitation of the refrigerating machine oil to gas side interunit piping from a compressor by attaching oil degradation decision equipment in the gas side interunit piping at the time of heating operation of the interunit piping which connects an outdoor unit and an indoor unit, it becomes possible to judge extent of oil degradation easily. Therefore, extent of degradation of refrigerating machine oil can be judged with an easy configuration, and dependability can be maintained over a long period of time by exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on the decision result. Moreover, while being able to apply this invention with an easy configuration, without carrying out the design change of outdoor and an indoor unit, this invention is easily applicable by exchanging interunit piping for interunit piping with oil degradation decision equipment also in an established air conditioner.

[0012] Moreover, the freezer of claim 3 is characterized by using a HFC system refrigerant in the freezer of claims 1 or 2.

[0013] According to the freezer of above-mentioned claim 3, since the synthetic oil used as refrigerating machine oil which has mutual solubility with a HFC refrigerant, such as an ether oil and ester oil, has the strong polarity, it is easy to melt residual impurities other than refrigerating machine oil and a refrigerant. Although it is easy to produce plugging and initial failure according [ the reduced pressure control which consisted of electric expansion valves ] to a sludge etc., extent of degradation of refrigerating machine oil is discovered at an early stage using the above-mentioned oil degradation decision equipment, and before fault occurs, it can deal with exchange of the refrigerant containing refrigerating machine oil etc.

[0014] Moreover, the freezer of claim 4 is characterized by using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more in the freezer of claims 1 or 2.

[0015] According to the freezer of above-mentioned claim 4, the synthetic oil used as refrigerating machine oil which has mutual solubility with the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more, such as an ether oil and ester oil. Since the polarity is strong, it is easy to melt residual impurities other than refrigerating machine oil and a refrigerant. Although it is easy to produce plugging and initial failure according [ the reduced pressure control which consisted of electric expansion valves ] to a sludge etc., extent of degradation of refrigerating machine oil is discovered at an early stage using the above-mentioned oil degradation decision equipment, and before fault occurs, it can deal with exchange of the refrigerant containing refrigerating machine oil etc.

[0016] Moreover, the freezer of claim 5 is characterized by preparing the simplified soil identification section in the above-mentioned oil degradation decision equipment in claim 1 thru/or any one freezer of 4.

[0017] According to the freezer of above-mentioned claim 5, extent of degradation of an oil can be easily judged by preparing the simplified soil identification section which judges extent which the chemical from which a color changes to the above-mentioned oil degradation decision equipment in response to moisture applies for example, compares the color of the chemical, and contains moisture.

[0018] Moreover, the freezer of claim 6 is characterized by preparing the simplified soil identification section by which the coloring matter which can judge oxidation of an oil was applied to the above-mentioned oil degradation decision equipment in claim 1 thru/or the freezer of 4.

[0019] According to the freezer of above-mentioned claim 6, extent of oxidation of an oil is judged by the color of the simplified soil identification section to which the coloring matter to which a color changes by the degree of oxidation of an oil was applied. For example, the degree of oxidation of an oil can be easily judged by change of the color of the pH indicator, using a pH indicator as coloring matter.

[0020] Moreover, the freezer of claim 7 is characterized by having a decision table for judging the degree of oxidation of the above-mentioned oil in the freezer of claim 6.

[0021] According to the freezer of above-mentioned claim 7, extent of degradation of an oil can be easily judged on that spot by preparing the decision table which compares the color of the above-mentioned coloring matter and judges the degree of oxidation of an oil.

[0022] Moreover, the wear powder decision equipment of claim 8 is characterized by using the magnet which can judge the amount of the wear powder in a refrigerant circuit.

[0023] According to the wear powder decision equipment of above-mentioned claim 8, it becomes possible to judge extent of the amount of the wear powder contained by the amount of the wear powder adhering to the above-mentioned magnet in a refrigerant. Therefore, by being able to judge extent of the wear powder in a refrigerant circuit with an easy configuration, and exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on the decision result, plugging of reduced pressure control etc. can be prevented and dependability can be maintained over a long period of time.

[0024] Moreover, the wear powder decision equipment of claim 9 is characterized by having a decision table for judging the amount of the above-mentioned wear powder in the freezer of claim 8.

[0025] According to the wear powder decision equipment of above-mentioned claim 9, extent of the amount of the wear powder contained in a refrigerant can be easily judged on that spot by preparing the decision table which judges the amount of wear powder as compared with the amount of the wear powder adhering to the above-mentioned magnet.

[0026] Moreover, the freezer of claim 10 is characterized by using the wear powder decision equipment of claims 8 or 9.

[0027] According to the freezer of above-mentioned claim 10, dependability can be maintained over a long period of time by judging extent of the amount of the wear powder in a refrigerant circuit with the above-mentioned wear powder decision equipment, and removing wear powder if needed based on the decision result.

[0028] Moreover, the refrigerant oxidation decision equipment of claim 11 is characterized by having the simplified soil identification section to which the coloring matter which can judge oxidation of a refrigerant was applied.

[0029] According to the refrigerant oxidation decision equipment of above-mentioned claim 11, extent of oxidation of a refrigerant is judged by the color of the simplified soil identification section to which the coloring matter to which a color changes by the degree of oxidation of a refrigerant was applied. For example, it becomes possible to judge the degree of oxidation of a refrigerant easily by change of the color of the pH indicator, using a pH indicator as coloring matter. Therefore, by being able to judge extent of oxidation of a refrigerant with an easy configuration, and exchanging an actuation medium (refrigerant

containing refrigerating machine oil) if needed based on the decision result, generating of fault can be prevented with the harmful matter is the decomposition product of a refrigerant, and dependability can be maintained over a long period of time.

[0030] Moreover, the refrigerant oxidation decision equipment of claim 12 is characterized by having a decision table for judging the degree of oxidation of the above-mentioned refrigerant in the refrigerant oxidation decision equipment of claim 11.

[0031] According to the refrigerant oxidation decision equipment of above-mentioned claim 12, extent of degradation of a refrigerant can be easily judged on that spot by preparing the decision table which compares the color of the above-mentioned coloring matter and judges the degree of oxidation of a refrigerant.

[0032] Moreover, the freezer of claim 13 is characterized by using the refrigerant oxidation decision equipment of claims 11 or 12.

[0033] According to the freezer of above-mentioned claim 13, by judging extent of oxidation of a refrigerant with the above-mentioned refrigerant oxidation decision equipment, and exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on the decision result, fluoric acid, a phosgene, etc. which are the decomposition product of a refrigerant can be removed, and dependability can be maintained over a long period of time.

[0034]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of illustration explains the freezer of this invention to a detail.

[0035] Drawing 1 is the circuit diagram showing the outline configuration of the air conditioner of the heat pump type as a freezer of the 1st operation gestalt of this invention. (The 1st operation gestalt) The 4 way change-over valve to which, as for 1, the compressor was connected to the discharge side of the above-mentioned compressor 1, and, as for 2, the end was connected, The outdoor heat exchanger by which, as for 3, the end was connected to the other end of the above-mentioned 4 way change-over valve 2, the electric expansion valve by which, as for 4, the end was connected to the other end of the above-mentioned outdoor heat exchanger 3, The indoor heat exchanger by which, as for 5, the end was connected to the other end of the above-mentioned electric expansion valve 4, and 6 are the accumulators by which the end was connected to the other end of the above-mentioned indoor heat exchanger 5 through the 4 way change-over valve 2, and the other end was connected to the inlet side of a compressor 1.

[0036] Moreover, the temperature sensor 11 with which the above-mentioned air conditioner detects the discharge-tube temperature of a compressor 1, The temperature sensor 12 which detects the coolant temperature of an outdoor heat exchanger 3, and the temperature sensor 13 which detects an OAT, The temperature sensor 14 which detects the coolant temperature of indoor heat exchanger 5, and the temperature sensor 15 which detects whenever [ room air temperature ], It has the temperature sensor 16 which detects the coolant temperature by the side of intake of the above-mentioned compressor 1, and the control unit 7 which controls a compressor 1 and electric expansion valve 4 grade in response to the signal from the above-mentioned temperature sensors 11-16. Moreover, while arranging the closing valve 21 between the above-mentioned electric expansion valve 4 and indoor heat exchanger 5, the closing valve 24 is arranged between indoor heat exchanger 5 and the 4 way change-over valve 2. Oil degradation decision equipment 31 is arranged between the closing valves 24 which become a gas side at the time of the above-mentioned 4 way change-over valve 2 and heating operation.

[0037] While constituting an outdoor unit 10 from the above-mentioned compressor 1, the 4 way change-over valve 2, an outdoor heat exchanger 3, the electric expansion valve 4, an accumulator 6, a control unit 7, the closing valve 21, the closing valve 24, temperature sensors 11-13, a temperature sensor 16, and an outdoor fan (not shown), the indoor unit 20 consists of indoor heat exchanger 5, a temperature sensor 14, a temperature sensor 15, and an indoor fan (not shown).

[0038] As shown in drawing 1, the above-mentioned oil degradation decision equipment 31 is site glass which prepared windowpane 31b in body of container 31a by which piping was connected to both ends, and extent of degradation of an oil judges the inside of body of container 31a visually from windowpane 31b, and judges black-ized resin-like composts, such as a sludge which adhered inside windowpane 31b, or a polymerization object visually.

[0039] Drawing 4 (A) - (D) shows the decision table established in oil degradation decision equipment 31.

[0040] Drawing 4 (A) compares with the color of a decision table 51 the color of the oil which adhered inside windowpane 31b, and judges extent of oil degradation. For example, it is shown that the oil is getting worse, so that the color of the oil which adhered inside windowpane 31b becomes black from brown.

[0041] Moreover, drawing 4 (B) applies the chemicals (cobalt etc.) from which a color changes according to

moisture content to the location which is visible through windowpane 31b in body of container 31a, compares the color of a chemical and color of a decision table 52 which were applied, and judges hydrous extent. For example, moisture water content increases, so that the color of a chemical becomes Green from yellow, and it is shown that the oil is getting worse.

[0042] Moreover, by the degree of oxidation of an oil, drawing 4 (C) applies coloring matter, such as a pH indicator which changes a color, to the location which is visible through windowpane 31b in body of container 31a, compares the color of coloring matter and color of a decision table 53 which were applied, and judges extent of oil degradation. For example, it is shown that the degree of oxidation becomes high, so that the color of coloring matter becomes red from blue, and the oil is getting worse.

[0043] Moreover, drawing 4 (D) applies the chemical from which a color changes extent including air according to air content to the location which is visible through windowpane 31b in body of container 31a, and judges extent which compares the applied chemical and color of a decision table 54, and includes air. for example, change of the color of a chemical — \*\* — it is shown that had and air content has increased.

[0044] Drawing 4 (A) Each decision tables 51–54 shown in – (D) are stuck near the both ends of the body 40 of a container, as shown in drawing 5 . In addition, drawing 5 shows the simplified soil identification sections 46 (the applied chemical, fixed magnet) which are visible through a windowpane 45 and its windowpane 45.

[0045] In the air conditioner of the above-mentioned configuration, since the gas refrigerant which contains many refrigerating machine oil in gas side piping by attaching oil degradation decision equipment 31 in gas side piping at the time of heating operation carries out the regurgitation, it becomes possible to judge extent of oil degradation easily.

[0046] Thus, extent of degradation of refrigerating machine oil can be judged with an easy configuration, and dependability can be maintained over a long period of time by exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on the decision result.

[0047] Moreover, extent of degradation of an oil can be easily judged on that spot by forming decision tables 51–54 near [ body of container 31a ] the above.

[0048] (The 2nd operation gestalt) Drawing 2 is the circuit diagram showing the outline configuration of the air conditioner of the heat pump type as a freezer of the 2nd operation gestalt of this invention, and except for oil degradation decision equipment, the same configuration as the air conditioner of the 1st operation gestalt is carried out, and the same configuration section attaches the same reference number, and omits explanation. This air conditioner is arranging oil degradation decision equipment 32 in the interunit piping 23 which becomes a gas side at the time of heating operation, as shown in drawing 2 .

[0049] Moreover, drawing 3 shows the interunit piping in which the above-mentioned oil degradation decision equipment was arranged, and may connect to connection of an outdoor unit and an indoor unit the other end of piping 41 by which the end was connected to the end of oil degradation decision equipment 40 with a flare groove joint, and the other end of piping 43 by which the end was connected to the other end of oil degradation decision equipment 40 may connect to connection of an outdoor unit and an indoor unit by high-pressure joints (a SUEJJI lock, double lock, etc.).

[0050] Extent of degradation of refrigerating machine oil can be judged with an easy configuration, and dependability can be kept being the same as that of the 1st operation gestalt also in this 2nd operation gestalt over a long period of time by exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on that decision result. Moreover, while being able to apply this invention with an easy configuration, without an outdoor unit and an indoor unit carrying out a design change, this invention is easily applicable by exchanging interunit piping for interunit piping with oil degradation decision equipment also in an established air conditioner.

[0051] With the above-mentioned 1st and 2nd operation gestalt, the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more as a HFC system refrigerant is used. In addition, it is the mixed refrigerant of R32 refrigerant and CO<sub>2</sub>, and 70 % of the weight or more and 90% of the weight or less of a mixed refrigerant is [ R32 refrigerant may also stop 70 % of the weight or more and 90% of the weight or less of a mixed refrigerant to CO<sub>2</sub>, and / it may be the mixed refrigerant of R32 refrigerant and R22 refrigerant, and ] sufficient as R32 refrigerant to R22 refrigerant.

[0052] Moreover, although the above-mentioned 1st and 2nd operation gestalt explained the air conditioner as a freezer equipped with oil degradation decision equipment 31, apart from oil degradation decision equipment, you may have wear powder decision equipment. This wear powder decision equipment embeds a magnet in the location which is visible through windowpane 31b in body of container 31a (shown in drawing 1 ), and judges extent which compares the color of the affix of the wear powder adhering to that magnet

with the color of a decision table 55 (shown in drawing 4 (E)), and contains wear powder. For example, it is shown that the color became deep, that there was much coating weight of wear powder, and wear powder has increased in number. In this case, by becoming possible to judge extent of the amount of the wear powder contained in a refrigerant, being able to judge extent of the wear powder in a refrigerant circuit with an easy configuration, and exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on that decision result with the amount of the wear powder adhering to the above-mentioned magnet, plugging of reduced pressure control etc. can be prevented and dependability can be maintained over a long period of time. Moreover, extent of degradation of a refrigerant can be easily judged on that spot by forming a decision table 55 near [ body of container 31a ] the above.

[0053] Moreover, apart from the above-mentioned oil degradation decision equipment and wear powder decision equipment, you may have refrigerant oxidation decision equipment. by the degree of oxidation of a refrigerant, this refrigerant oxidation decision equipment applies coloring matter, such as a pH indicator which changes a color, to the location which is visible through windowpane 31b in body of container 31a (shown in drawing 1 ), compares that color of coloring matter and color of a decision table ( drawing 4 (C) - the same) that were applied, and judges extent of oxidation of a refrigerant. In this case, by being able to judge the amount of harmful matter, such as a phosgene which is the decomposition product of fluoric acid or a HCFC refrigerant which is a decomposition product of a HFC refrigerant, and exchanging an actuation medium if needed based on that decision result, degradation of each part by harmful matter can be prevented, and dependability can be maintained over a long period of time. Moreover, extent of degradation of a refrigerant can be easily judged on that spot by preparing a decision table near [ body of container 31a ] the above.

[0054]

[Effect of the Invention] As mentioned above, the freezer of invention of claim 1 is equipped with the oil degradation decision equipment for judging extent of degradation of the refrigerating machine oil arranged between the discharge side of a compressor and a gas closing valve or between the 4 way change-over valve and the gas closing valve so that clearly.

[0055] therefore, according to the freezer of invention of claim 1, between the discharge sides of a compressor and gas closing valves which arranged the above-mentioned oil degradation decision equipment (or between a 4 way change-over valve and gas closing valves) Since the included gas refrigerant carries out the regurgitation of the refrigerating machine oil from a compressor, extent of degradation of refrigerating machine oil can be judged with an easy configuration, and dependability can be maintained over a long period of time by exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on the decision result.

[0056] Moreover, the freezer of invention of claim 2 is equipped with the oil degradation decision equipment for judging extent of degradation of the refrigerating machine oil arranged in gas side interunit piping.

[0057] Therefore, according to the freezer of invention of claim 2, it is gas side interunit piping at the time of heating operation of the interunit piping which connects an outdoor unit and an indoor unit. In the gas side interunit piping which arranged the above-mentioned oil degradation decision equipment Since the included gas refrigerant carries out the regurgitation of the refrigerating machine oil from a compressor, extent of degradation of refrigerating machine oil can be judged with an easy configuration, and dependability can be maintained over a long period of time by exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on the decision result. Moreover, while being able to apply this invention with an easy configuration, without carrying out the design change of outdoor and an indoor unit, this invention is easily applicable by exchanging interunit piping for interunit piping with oil degradation decision equipment also in an established air conditioner.

[0058] Moreover, according to the freezer of invention of claim 3, in the freezer of claims 1 or 2, even if it uses the HFC system refrigerant with which it tends to get reduced pressure control blocked by a sludge etc., extent of degradation of refrigerating machine oil is discovered at an early stage using the above-mentioned oil degradation decision equipment, and before fault occurs, it can deal with exchange of the refrigerant containing refrigerating machine oil etc.

[0059] Moreover, in the freezer of claims 1 or 2, even if the mixed refrigerant with which reduced pressure control contains R32 refrigerant which is easy to get it blocked by a sludge etc., or R32 at least 70% of the weight or more is used for it, the freezer of invention of claim 4 discovers extent of degradation of refrigerating machine oil at an early stage using the above-mentioned oil degradation decision equipment, and before fault occurs, it can deal with exchange of the refrigerant containing refrigerating machine oil etc.

[0060] Moreover, in claim 1 thru/or any one freezer of 4, since the freezer of invention of claim 5 prepared



the simplified soil identification section in the above-mentioned oil degradation decision equipment, it can judge extent of degradation of an oil easily.

[0061] Moreover, since the simplified soil identification section by which the coloring matter which can judge oxidation of an oil was applied to the above-mentioned oil degradation decision equipment was prepared in claim 1 thru/or the freezer of 4 according to the freezer of invention of claim 6, by the degree of oxidation of an oil, extent of oxidation of an oil can be judged by the color of the simplified soil identification section to which the coloring matter to which a color changes was applied, and the degree of oxidation of an oil can be judged easily.

[0062] Moreover, according to the freezer of invention of claim 7, in the freezer of claim 6, extent of degradation of an oil can be easily judged on that spot by preparing the decision table which compares the color of the above-mentioned coloring matter and judges the degree of oxidation of an oil.

[0063] Moreover, since the magnet which can judge the amount of the wear powder in a refrigerant circuit was used according to the wear powder decision equipment of invention of claim 8 By being able to judge easily extent of the amount of the wear powder contained in a refrigerant with an easy configuration, and exchanging an actuation medium if needed based on the decision result with the amount of the wear powder adhering to the above-mentioned magnet, plugging of reduced pressure control etc. can be prevented and dependability can be maintained over a long period of time.

[0064] Moreover, according to the wear powder decision equipment of invention of claim 9, in the freezer of claim 8, extent of the amount of the wear powder contained in a refrigerant can be easily judged on that spot by preparing the decision table which judges the amount of wear powder as compared with the amount of the wear powder adhering to the above-mentioned magnet.

[0065] Moreover, according to the freezer of invention of claim 10, since the wear powder decision equipment of claims 8 or 9 was used, dependability can be maintained over a long period of time by judging extent of the amount of the wear powder in a refrigerant circuit with the above-mentioned wear powder decision equipment, and removing wear powder if needed based on the decision result.

[0066] Moreover, since it had the simplified soil identification section to which the coloring matter which can judge oxidation of a refrigerant was applied according to the refrigerant oxidation decision equipment of invention of claim 11 Extent of oxidation of a refrigerant can be judged by the color of the simplified soil identification section to which the coloring matter to which a color changes by the degree of oxidation of a refrigerant was applied. By being able to judge the degree of oxidation of a refrigerant easily with an easy configuration, and exchanging an actuation medium if needed based on the decision result, generating of the fault by the decomposition product of a refrigerant can be prevented, and dependability can be maintained over a long period of time.

[0067] Moreover, the refrigerant oxidation decision equipment of invention of claim 12 can judge extent of degradation of a refrigerant easily on that spot in the refrigerant oxidation decision equipment of claim 11 by preparing the decision table which compares the color of the above-mentioned coloring matter and judges the degree of oxidation of a refrigerant.

[0068] Moreover, since the refrigerant oxidation decision equipment of claims 11 or 12 was used for the freezer of invention of claim 13, by judging extent of oxidation of a refrigerant with the above-mentioned refrigerant oxidation decision equipment, and exchanging an actuation medium (refrigerant containing refrigerating machine oil) if needed based on the decision result, it can remove fluoric acid, a phosgene, etc. which are the decomposition product of a refrigerant, and can maintain dependability over a long period of time.

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

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## [Brief Description of the Drawings]

[Drawing 1] Drawing 1 is the circuit diagram of the freezer of the 1st operation gestalt of this invention.

[Drawing 2] Drawing 2 is the circuit diagram of the freezer of the 2nd operation gestalt of this invention.

[Drawing 3] Drawing 3 is the schematic diagram of the oil degradation decision equipment arranged in the interunit piping of the above-mentioned freezer.

[Drawing 4] Drawing 4 is drawing showing the decision table for the simplified soil identification sections.

[Drawing 5] Drawing 5 is drawing showing the attachment location of the above-mentioned decision table.

## [Description of Notations]

1 [ -- An electric expansion valve, 5 / -- An outdoor heat exchanger, 6 / -- An accumulator, 7 / -- A control unit, 10 / -- An outdoor unit, 20 / -- 21 An indoor unit, 24 / -- 22 A closing valve, 23 / -- 31 Interunit piping, 32 / -- Oil degradation decision equipment. ] -- A compressor, 2 -- A 4 way change-over valve, 3 -- An outdoor heat exchanger, 4

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[Translation done.]

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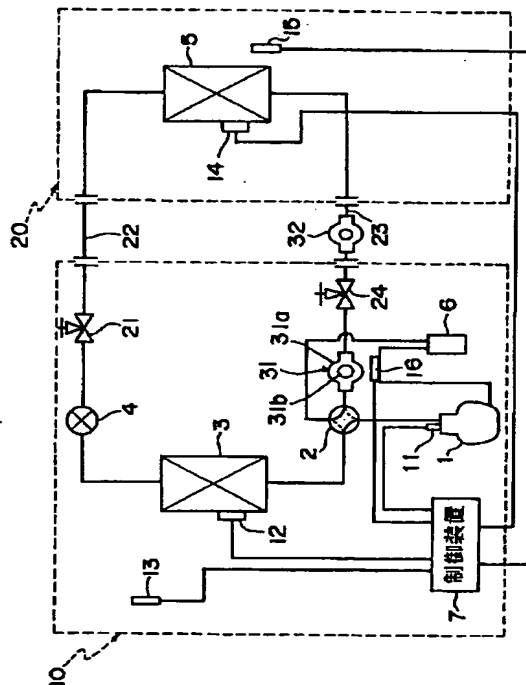
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(54) 【発明の名称】 冷凍装置および磨耗粉判断装置および冷媒酸化判断装置

(57) 【要約】

【課題】 簡単な構成で冷凍機油の劣化の程度を判断でき、長期信頼性を保つことができる冷凍装置を提供する。

【解決手段】 四路切換弁2とガス閉鎖弁24との間に配設された油劣化判断容器31を備える。暖房運転時に冷凍機油を多く含むガス冷媒が圧縮機1から吐出するので、油劣化の程度を容易に判断できる。



# 【特許請求の範囲】

【請求項1】 圧縮機(1)の吐出側とガス閉鎖弁(24)との間または四路切換弁(2)とガス閉鎖弁(24)との間に配設された冷凍機油の劣化の程度を判断するための油劣化判断装置(31)を備えたことを特徴とする冷凍装置。

【請求項2】 ガス側連絡配管(23)に配設された冷凍機油の劣化の程度を判断するための油劣化判断装置(32)を備えたことを特徴とする冷凍装置。

【請求項3】 請求項1または2に記載の冷凍装置において、HFC系冷媒を用いたことを特徴とする冷凍装置。

【請求項4】 請求項1または2に記載の冷凍装置において、R32冷媒またはR32を少なくとも70重量%以上含む混合冷媒を用いたことを特徴とする冷凍装置。

【請求項5】 請求項1乃至4のいずれか1つに記載の冷凍装置において、上記油劣化判断装置(31,32)に簡易判断部を設けたことを特徴とする冷凍装置。

【請求項6】 請求項1乃至4に記載の冷凍装置において、上記油劣化判断装置(31,32)に、油の酸化を判断可能な色素が塗布された簡易判断部を設けたことを特徴とする冷凍装置。

【請求項7】 請求項6に記載の冷凍装置において、上記油の酸化の度合いを判断するための判断表(53)を備えたことを特徴とする冷凍装置。

【請求項8】 冷媒回路内の磨耗粉の量を判断可能な磁石を用いたことを特徴とする磨耗粉判断装置。

【請求項9】 請求項8に記載の磨耗粉判断装置において、上記磨耗粉の量を判断するための判断表(55)を備えたことを特徴とする冷凍装置。

【請求項10】 請求項8または9に記載の磨耗粉判断装置を用いたことを特徴とする冷凍装置。

【請求項11】 冷媒の酸化を判断可能な色素が塗布された簡易判断部を備えたことを特徴とする冷媒酸化判断装置。

【請求項12】 請求項11に記載の冷凍装置において、上記冷媒の酸化の度合いを判断するための判断表を備えたことを特徴とする冷凍装置。

【請求項13】 請求項11または12に記載の冷媒酸化判断装置を用いたことを特徴とする冷凍装置。

## 【発明の詳細な説明】

### 【0001】

【発明の属する技術分野】この発明は、冷凍装置および磨耗粉判断装置および冷媒酸化判断装置に関する。

### 【0002】

【従来の技術および発明が解決しようとする課題】冷媒

を用いたヒートポンプ方式の冷凍装置において、オゾン層破壊係数が大きいHFC系冷媒がフロン規制の対象となったことから、その代替冷媒として、オゾン層破壊係数ゼロのHFC系冷媒が用いられている。このHFC冷媒を用いた冷凍装置では、冷凍機油とHFC冷媒との相互溶解性が重要な特性の一つとなるため、エーテル油やエステル油等の合成油が冷凍機油として用いられる。しかしながら、上記合成油は極性が強く、そのため冷凍機油および冷媒以外の残留不純物を溶かしやすいため、電動膨張弁で構成された減圧機構において、冷媒が蒸発した後のスラッジ等による詰まりや初期不良が生じて、冷凍サイクルに異常が発生して信頼性が低下するという問題がある。

【0003】また、上記冷凍装置では、圧縮機等から冷媒回路内に出る磨耗粉の量を判断する手段がないため、磨耗粉を除去する時期を判断できず、電動膨張弁で構成された減圧機構において、磨耗粉による詰まりや初期不良が生じて、長期信頼性を確保することができないという問題がある。

【0004】また、上記冷凍装置では、冷媒の酸化により生じる分解生成物(フッ酸やホスゲン等の有害物質)の量を判断する手段がないため、劣化した冷媒の交換の時期を判断できず、長期信頼性を確保することができないという問題がある。

【0005】そこで、この発明の目的は、簡単な構成で冷凍機油の劣化の程度を判断でき、減圧機構の詰まりを防止して、長期信頼性を保つことができる冷凍装置を提供することにある。

【0006】また、この発明のもう一つ目的は、簡単な構成で冷媒回路内の磨耗粉の量を判断でき、減圧機構の詰まりを防止して、冷凍装置等の長期信頼性を保つことができる磨耗粉判断装置を提供することにある。

【0007】また、この発明のもう一つ目的は、簡単な構成で冷媒の酸化の程度を判断でき、冷凍装置等の長期信頼性を保つことができる冷媒酸化判断装置を提供することにある。

### 【0008】

【課題を解決するための手段】上記目的を達成するため、請求項1の冷凍装置は、圧縮機の吐出側とガス閉鎖弁との間または四路切換弁とガス閉鎖弁との間に配設された冷凍機油の劣化の程度を判断するための油劣化判断装置を備えたことを特徴としている。

【0009】上記請求項1の冷凍装置によれば、圧縮機の吐出側とガス閉鎖弁との間または四路切換弁とガス閉鎖弁との間(暖房運転時のガス側配管)に油劣化判断装置を取り付けることによって、ガス側配管には冷凍機油を多く含むガス冷媒が圧縮機から吐出するので、油劣化の程度を容易に判断することが可能となる。したがって、簡単な構成で冷凍機油の劣化の程度を判断でき、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含

む冷媒)を交換することによって、減圧機構の詰まり等を防止して、長期信頼性を保つことができる。

【0010】また、請求項2の冷凍装置は、ガス側連絡配管に配設された冷凍機油の劣化の程度を判断するための油劣化判断装置を備えたことを特徴としている。

【0011】上記請求項2の冷凍装置によれば、室外ユニット、室内ユニットを有するスプリットタイプでは、室外ユニット、室内ユニットを接続する連絡配管のうちの暖房運転時のガス側連絡配管に油劣化判断装置を取り付けることによって、ガス側連絡配管には冷凍機油を多く含むガス冷媒が圧縮機から吐出するので、油劣化の程度を容易に判断することが可能となる。したがって、簡単な構成で冷凍機油の劣化の程度を判断でき、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、長期信頼性を保つことができる。また、室外、室内ユニットの設計変更をすることなく、簡単な構成でこの発明を適用できると共に、既設の空気調和機においても連絡配管を油劣化判断装置付きの連絡配管に交換することによって、この発明を容易に適用することができる。

【0012】また、請求項3の冷凍装置は、請求項1または2の冷凍装置において、HFC系冷媒を用いたことを特徴としている。

【0013】上記請求項3の冷凍装置によれば、HFC冷媒との相互溶解性を有する冷凍機油として用いられるエーテル油やエステル油等の合成油は極性が強いために冷凍機油および冷媒以外の残留不純物を溶かしやすく、電動膨張弁で構成された減圧機構がスラッジ等による詰まりや初期不良が生じやすいが、上記油劣化判断装置を用いて冷凍機油の劣化の程度を早期に発見して、不具合が発生する前に冷凍機油を含む冷媒の交換等の処置を行うことができる。

【0014】また、請求項4の冷凍装置は、請求項1または2の冷凍装置において、R32冷媒またはR32を少なくとも70重量%以上含む混合冷媒を用いたことを特徴としている。

【0015】上記請求項4の冷凍装置によれば、R32冷媒またはR32を少なくとも70重量%以上含む混合冷媒との相互溶解性を有する冷凍機油として用いられるエーテル油やエステル油等の合成油は、極性が強いために冷凍機油および冷媒以外の残留不純物を溶かしやすく、電動膨張弁で構成された減圧機構がスラッジ等による詰まりや初期不良が生じやすいが、上記油劣化判断装置を用いて冷凍機油の劣化の程度を早期に発見して、不具合が発生する前に冷凍機油を含む冷媒の交換等の処置を行うことができる。

【0016】また、請求項5の冷凍装置は、請求項1乃至4のいずれか1つの冷凍装置において、上記油劣化判断装置に簡易判断部を設けたことを特徴としている。

【0017】上記請求項5の冷凍装置によれば、例え

ば、上記油劣化判断装置に水分に反応して色が変化する化学物質が塗布して、その化学物質の色を比較して水分を含む程度を判断する簡易判断部を設けることによって、油の劣化の程度を容易に判断することができる。

【0018】また、請求項6の冷凍装置は、請求項1乃至4の冷凍装置において、上記油劣化判断装置に、油の酸化を判断可能な色素が塗布された簡易判断部を設けたことを特徴としている。

【0019】上記請求項6の冷凍装置によれば、油の酸化の度合いによって色が変わる色素が塗布された簡易判断部の色により油の酸化の程度を判断する。例えば、色素としてpH指示薬を用いて、そのpH指示薬の色の变化により油の酸化の度合いを容易に判断できる。

【0020】また、請求項7の冷凍装置は、請求項6の冷凍装置において、上記油の酸化の度合いを判断するための判断表を備えたことを特徴としている。

【0021】上記請求項7の冷凍装置によれば、上記色素の色を比較して油の酸化の度合いを判断する判断表を設けることによって、油の劣化の程度をその場で容易に判断することができる。

【0022】また、請求項8の磨耗粉判断装置は、冷媒回路内の磨耗粉の量を判断可能な磁石を用いたことを特徴としている。

【0023】上記請求項8の磨耗粉判断装置によれば、上記磁石に付着する磨耗粉の量によって冷媒中に含まれる磨耗粉の量の程度を判断することが可能となる。したがって、簡単な構成で冷媒回路内の磨耗粉の程度を判断でき、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、減圧機構の詰まり等を防止して、長期信頼性を保つことができる。

【0024】また、請求項9の磨耗粉判断装置は、請求項8の冷凍装置において、上記磨耗粉の量を判断するための判断表を備えたことを特徴としている。

【0025】上記請求項9の磨耗粉判断装置によれば、上記磁石に付着した磨耗粉の量と比較して磨耗粉の量を判断する判断表を設けることによって、冷媒中に含まれる磨耗粉の量の程度をその場で容易に判断することができる。

【0026】また、請求項10の冷凍装置は、請求項8または9の磨耗粉判断装置を用いたことを特徴としている。

【0027】上記請求項10の冷凍装置によれば、上記磨耗粉判断装置により冷媒回路内の磨耗粉の量の程度を判断して、その判断結果に基づいて必要に応じて磨耗粉を除去することによって、長期信頼性を保つことができる。

【0028】また、請求項11の冷媒酸化判断装置は、冷媒の酸化を判断可能な色素が塗布された簡易判断部を備えたことを特徴としている。

【0029】上記請求項11の冷媒酸化判断装置によれば、冷媒の酸化の度合いによって色が変わる色素が塗布された簡易判断部の色により冷媒の酸化の程度を判断する。例えば、色素としてpH指示薬を用いて、そのpH指示薬の色の変化により冷媒の酸化の度合いを容易に判断することが可能となる。したがって、簡単な構成で冷媒の酸化の程度を判断でき、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、冷媒の分解生成物である有害物質により不具合の発生を防止して、長期信頼性を保つことができる。

【0030】また、請求項12の冷媒酸化判断装置は、請求項11の冷媒酸化判断装置において、上記冷媒の酸化の度合いを判断するための判断表を備えたことを特徴としている。

【0031】上記請求項12の冷媒酸化判断装置によれば、上記色素の色を比較して冷媒の酸化の度合いを判断する判断表を設けることによって、冷媒の劣化の程度をその場で容易に判断することができる。

【0032】また、請求項13の冷凍装置は、請求項11または12の冷媒酸化判断装置を用いたことを特徴としている。

【0033】上記請求項13の冷凍装置によれば、上記冷媒酸化判断装置により冷媒の酸化の程度を判断して、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、冷媒の分解生成物である例えばフッ酸やホスゲン等を除去でき、長期信頼性を保つことができる。

【0034】

【発明の実施の形態】以下、この発明の冷凍装置を図示の実施の形態により詳細に説明する。

【0035】(第1実施形態)図1はこの発明の第1実施形態の冷凍装置としてのヒートポンプ式の空気調和機の概略構成を示す回路図であり、1は圧縮機、2は上記圧縮機1の吐出側に一端が接続された四路切換弁、3は上記四路切換弁2の他端に一端が接続された室外熱交換器、4は上記室外熱交換器3の他端に一端が接続された電動膨張弁、5は上記電動膨張弁4の他端に一端が接続された室内熱交換器、6は上記室内熱交換器5の他端に四路切換弁2を介して一端が接続され、他端が圧縮機1の吸入側に接続されたアキュムレータである。

【0036】また、上記空気調和機は、圧縮機1の吐出管温度を検出する温度センサ11と、室外熱交換器3の冷媒温度を検出する温度センサ12と、外気温度を検出する温度センサ13と、室内熱交換器5の冷媒温度を検出する温度センサ14と、室内温度を検出する温度センサ15と、上記圧縮機1の吸込側の冷媒温度を検出する温度センサ16と、上記温度センサ11～16からの信号を受けて、圧縮機1、電動膨張弁4等を制御する制御装置7とを備えている。また、上記電動膨張弁4と室内

熱交換器5との間に閉鎖弁21を配設すると共に、室内熱交換器5と四路切換弁2との間に閉鎖弁24を配設している。上記四路切換弁2と暖房運転時にガス側となる閉鎖弁24との間に油劣化判断装置31を配設している。

【0037】上記圧縮機1、四路切換弁2、室外熱交換器3、電動膨張弁4、アキュムレータ6、制御装置7、閉鎖弁21、閉鎖弁24、温度センサ11～13、温度センサ16および室外ファン(図示せず)で室外ユニット10を構成すると共に、室内熱交換器5、温度センサ14、温度センサ15および室内ファン(図示せず)で室内ユニット20を構成している。

【0038】図1に示すように、上記油劣化判断装置31は、両端に配管が接続された容器本体31aに窓ガラス31bを設けたサイトガラスであり、油の劣化の程度は窓ガラス31bから容器本体31a内を目視で判断し、窓ガラス31bの内側に付着したスラッジ等の黒色化した樹脂状の合成物または重合物を目視で判断する。

【0039】図4(A)～(D)は油劣化判断装置31に設ける判断表を示している。

【0040】図4(A)は、窓ガラス31bの内側に付着した油の色と判断表51の色とを比較して油劣化の程度を判断する。例えば、窓ガラス31bの内側に付着した油の色が茶色から黒色になるほど、油が悪くなっていることを示している。

【0041】また、図4(B)は、水分含有率に応じて色が変化する化学物質(コバルト等)を容器本体31a内の窓ガラス31bを介して見える位置に塗布し、その塗布された化学物質の色と判断表52の色とを比較して含水の程度を判断する。例えば、化学物質の色が黄色からグリーンになるほど水分含水率が多くなり、油が悪くなっていることを示している。

【0042】また、図4(C)は、油の酸化の度合いによって色が変わるpH指示薬等の色素を容器本体31a内の窓ガラス31bを介して見える位置に塗布し、その塗布された色素の色と判断表53の色とを比較して油劣化の程度を判断する。例えば、色素の色が青から赤になるほど酸化の度合いが高くなって、油が悪くなっていることを示している。

【0043】また、図4(D)は、空気を含む程度を空気含有率に応じて色が変化する化学物質を容器本体31a内の窓ガラス31bを介して見える位置に塗布し、その塗布された化学物質と判断表54の色とを比較して空気を含む程度を判断する。例えば、化学物質の色の変化にともって、空気含有率が多くなっていることを示している。

【0044】図4(A)～(D)に示す各判断表51～54は、図5に示すように、容器本体40の両端近傍に貼り付ける。なお、図5では、窓ガラス45とその窓ガラス45を介して見える簡易判断部46(塗布された化学物

質、固定された磁石等)を示している。

【0045】上記構成の空気調和機では、暖房運転時のガス側配管に油劣化判断装置31を取り付けることによって、ガス側配管に冷凍機油を多く含むガス冷媒が吐出するので、油劣化の程度を容易に判断することが可能となる。

【0046】このようにして、簡単な構成で冷凍機油の劣化の程度を判断でき、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、長期信頼性を保つことができる。

【0047】また、上記容器本体31a近傍に判断表51〜54を設けることによって、油の劣化の程度をその場で容易に判断することができる。

【0048】(第2実施形態)図2はこの発明の第2実施形態の冷凍装置としてのヒートポンプ式の空気調和機の概略構成を示す回路図であり、油劣化判断装置を除き第1実施形態の空気調和機と同一の構成をしており、同一構成部は同一参照番号を付して説明を省略する。この空気調和機は、図2に示すように、暖房運転時にガス側となる連絡配管23に油劣化判断装置32を配設している。

【0049】また、図3は上記油劣化判断装置が配設された連絡配管を示しており、油劣化判断装置40の一端に一端が接続された配管41の他端をフレア継手により室外ユニットおよび室内ユニットの接続に接続してもよいし、油劣化判断装置40の他端に一端が接続された配管43の他端を高圧継手(スエッジロックや2重ロック等)により室外ユニットおよび室内ユニットの接続に接続してもよい。

【0050】この第2実施形態の場合も第1実施形態と同様に、簡単な構成で冷凍機油の劣化の程度を判断でき、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、長期信頼性を保つことができる。また、室外ユニット、室内ユニットの設計変更することなく、簡単な構成でこの発明を適用できると共に、既設の空気調和機においても連絡配管を油劣化判断装置付きの連絡配管に交換することによって、この発明を容易に適用することができる。

【0051】上記第1、第2実施形態では、HFC系冷媒としてR32冷媒またはR32を少なくとも70重量%以上含む混合冷媒を用いている。なお、R32冷媒とCO<sub>2</sub>との混合冷媒であって、CO<sub>2</sub>に対してR32冷媒が70重量%以上かつ90重量%以下の混合冷媒でもよし、R32冷媒とR22冷媒との混合冷媒であって、R22冷媒に対してR32冷媒が70重量%以上かつ90重量%以下の混合冷媒でもよい。

【0052】また、上記第1、第2実施形態では、油劣化判断装置31を備えた冷凍装置としての空気調和機について説明したが、油劣化判断装置とは別に磨耗粉判断装置を備えてもよい。この磨耗粉判断装置は、容器本体

31a(図1に示す)内の窓ガラス31bを介して見える位置に磁石を埋め込み、その磁石に付着した磨耗粉の付着物の色と判断表55(図4(E)に示す)の色とを比較して磨耗粉を含む程度を判断する。例えば、磨耗粉の付着量が多いほど色が濃くなって、磨耗粉が多くなっていることを示している。この場合、上記磁石に付着する磨耗粉の量によって冷媒中に含まれる磨耗粉の量の程度を判断することが可能となり、簡単な構成で冷媒回路内の磨耗粉の程度を判断でき、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、減圧機構の詰まり等を防止して、長期信頼性を維持することができる。また、上記容器本体31a近傍に判断表55を設けることによって、冷媒の劣化の程度をその場で容易に判断することができる。

【0053】また、上記油劣化判断装置、磨耗粉判断装置とは別に冷媒酸化判断装置を備えてもよい。この冷媒酸化判断装置は、冷媒の酸化の度合いによって色が変化するpH指示薬等の色素を容器本体31a(図1に示す)内の窓ガラス31bを介して見える位置に塗布し、その塗布された色素の色と判断表(図4(C)と同様)の色とを比較して冷媒の酸化の程度を判断する。この場合、HFC冷媒の分解生成物であるフッ酸やHCFC冷媒の分解生成物であるホスゲン等の有害物質の量を判断でき、その判断結果に基づいて必要に応じて作動媒体を交換することによって、有害物質による各部の劣化を防止でき、長期信頼性を維持することができる。また、上記容器本体31a近傍に判断表を設けることによって、冷媒の劣化の程度をその場で容易に判断することができる。

【0054】

【発明の効果】以上より明らかなように、請求項1の発明の冷凍装置は、圧縮機の吐出側とガス閉鎖弁との間または四路切換弁とガス閉鎖弁との間に配設された冷凍機油の劣化の程度を判断するための油劣化判断装置を備えたものである。

【0055】したがって、請求項1の発明の冷凍装置によれば、上記油劣化判断装置を配設した圧縮機の吐出側とガス閉鎖弁との間(または四路切換弁とガス閉鎖弁との間)では、冷凍機油を多く含むガス冷媒が圧縮機から吐出するので、簡単な構成で冷凍機油の劣化の程度を判断でき、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、長期信頼性を保つことができる。

【0056】また、請求項2の発明の冷凍装置は、ガス側連絡配管に配設された冷凍機油の劣化の程度を判断するための油劣化判断装置を備えたものである。

【0057】したがって、請求項2の発明の冷凍装置によれば、室外ユニット、室内ユニットを接続する連絡配管のうちの暖房運転時のガス側連絡配管であって、上記油劣化判断装置を配設したガス側連絡配管では、冷凍機油を多く含むガス冷媒が圧縮機から吐出するので、簡単

な構成で冷凍機油の劣化の程度を判断でき、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、長期信頼性を保つことができる。また、室外、室内ユニットの設計変更をすることなく、簡単な構成でこの発明を適用できると共に、既設の空気調和機においても連絡配管を油劣化判断装置付きの連絡配管に交換することによって、この発明を容易に適用することができる。

【0058】また、請求項3の発明の冷凍装置によれば、請求項1または2の冷凍装置において、減圧機構がスラッジ等により詰まりやすいHFC系冷媒を用いても、上記油劣化判断装置を用いて冷凍機油の劣化の程度を早期に発見して、不具合が発生する前に冷凍機油を含む冷媒の交換等の処置を行うことができる。

【0059】また、請求項4の発明の冷凍装置は、請求項1または2の冷凍装置において、減圧機構がスラッジ等により詰まりやすいR32冷媒またはR32を少なくとも70重量%以上含む混合冷媒を用いても、上記油劣化判断装置を用いて冷凍機油の劣化の程度を早期に発見して、不具合が発生する前に冷凍機油を含む冷媒の交換等の処置を行うことができる。

【0060】また、請求項5の発明の冷凍装置は、請求項1乃至4のいずれか1つの冷凍装置において、上記油劣化判断装置に簡易判断部を設けたので、油の劣化の程度を容易に判断することができる。

【0061】また、請求項6の発明の冷凍装置によれば、請求項1乃至4の冷凍装置において、上記油劣化判断装置に、油の酸化を判断可能な色素が塗布された簡易判断部を設けたので、油の酸化の度合いによって色が変わる色素が塗布された簡易判断部の色により油の酸化の程度を判断でき、油の酸化の度合いを容易に判断できる。

【0062】また、請求項7の発明の冷凍装置によれば、請求項6の冷凍装置において、上記色素の色を比較して油の酸化の度合いを判断する判断表を設けることによって、油の劣化の程度をその場で容易に判断することができる。

【0063】また、請求項8の発明の磨耗粉判断装置によれば、冷媒回路内の磨耗粉の量を判断可能な磁石を用いたので、上記磁石に付着する磨耗粉の量によって冷媒中に含まれる磨耗粉の量の程度を簡単な構成で容易に判断でき、その判断結果に基づいて必要に応じて作動媒体を交換することによって、減圧機構の詰まり等を防止して、長期信頼性を保つことができる。

【0064】また、請求項9の発明の磨耗粉判断装置によれば、請求項8の冷凍装置において、上記磁石に付着した磨耗粉の量と比較して磨耗粉の量を判断する判断表

を設けることによって、冷媒中に含まれる磨耗粉の量の程度をその場で容易に判断することができる。

【0065】また、請求項10の発明の冷凍装置によれば、請求項8または9の磨耗粉判断装置を用いたので、上記磨耗粉判断装置により冷媒回路内の磨耗粉の量の程度を判断して、その判断結果に基づいて必要に応じて磨耗粉を除去することによって、長期信頼性を保つことができる。

【0066】また、請求項11の発明の冷媒酸化判断装置によれば、冷媒の酸化を判断可能な色素が塗布された簡易判断部を備えたので、冷媒の酸化の度合いによって色が変わる色素が塗布された簡易判断部の色により冷媒の酸化の程度を判断でき、冷媒の酸化の度合いを簡単な構成で容易に判断でき、その判断結果に基づいて必要に応じて作動媒体を交換することによって、冷媒の分解生成物による不具合の発生を防止して、長期信頼性を保つことができる。

【0067】また、請求項12の発明の冷媒酸化判断装置は、請求項11の冷媒酸化判断装置において、上記色素の色を比較して冷媒の酸化の度合いを判断する判断表を設けることによって、冷媒の劣化の程度をその場で容易に判断することができる。

【0068】また、請求項13の発明の冷凍装置は、請求項11または12の冷媒酸化判断装置を用いたので、上記冷媒酸化判断装置により冷媒の酸化の程度を判断して、その判断結果に基づいて必要に応じて作動媒体(冷凍機油を含む冷媒)を交換することによって、冷媒の分解生成物である例えばフッ酸やホスゲン等を除去でき、長期信頼性を保つことができる。

#### 【図面の簡単な説明】

【図1】 図1はこの発明の第1実施形態の冷凍装置の回路図である。

【図2】 図2はこの発明の第2実施形態の冷凍装置の回路図である。

【図3】 図3は上記冷凍装置の連絡配管に配設された油劣化判断装置の概略図である。

【図4】 図4は簡易判断部用の判断表を示す図である。

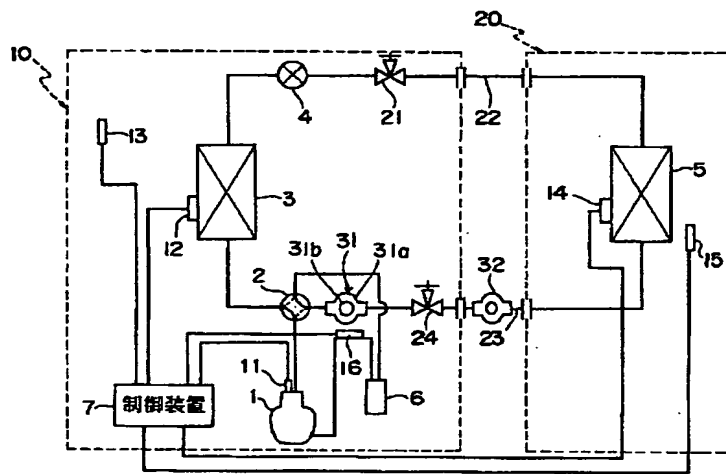
【図5】 図5は上記判断表の貼り付け位置を示す図である。

#### 【符号の説明】

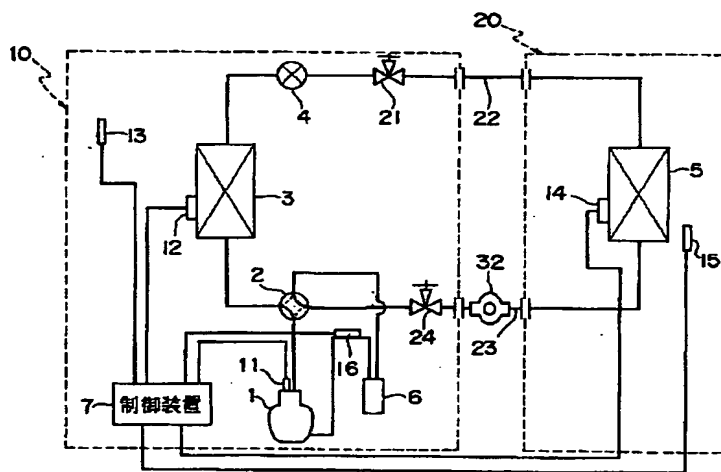
1…圧縮機、2…四路切換弁、3…室外熱交換器、4…電動膨張弁、5…室外熱交換器、6…アキュムレータ、7…制御装置、10…室外ユニット、20…室内ユニット、21,24…閉鎖弁、22,23…連絡配管、31,32…油劣化判断装置。



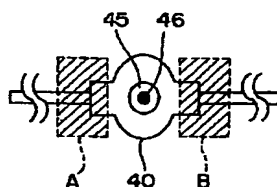
【図1】



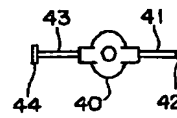
【図2】



【図5】



【図3】



【図4】

- (A) 油劣化: 黒 茶 51  
(色素) 悪 ← 良好
- (B) 水分: グリーン 黄色 52  
(1%以上含む) 悪 ← 良好
- (C) 油劣化: 赤 青 53  
(酸化) 悪 ← 良好
- (D) 空気: 一色の変化 54  
悪 ← 良好
- (E) 摩耗粉: 多 付着量 少 55  
悪 ← 良好